Amendments

to the

Water Quality Control Plan – Los Angeles Region

With respect to

Inland Surface Water Ammonia Objectives

Amendments:

Chapter 3. Water Quality Objectives

Ammonia

Ammonia is a pollutant routinely found in the wastewater effluent of Publicly Owned Treatment Works (POTWs), in landfill-leachate, as well as in run-off from agricultural fields where commercial fertilizers and animal manure are applied. Ammonia exists in two forms – un-ionized ammonia (NH_3) and the ammonium ion (NH_4^+). They are both toxic, but the neutral, un-ionized ammonia species (NH_3) is highly toxic to fish and other aquatic life. The ratio of toxic NH_3 to total ammonia ($NH_4^+ + NH_3$) is primarily a function of pH, but it is also affected by temperature and other factors. Additional impacts can also occur as the oxidation of ammonia lowers the dissolved oxygen content of the water, further stressing aquatic organisms. Ammonia also combines with chlorine (often both are present) to form chloramines – persistent toxic compounds that extend the effects of ammonia and chlorine downstream.

Oxidation of ammonia to nitrate may lead to groundwater impacts in areas of recharge.

The acute objective is dependent on pH and fish species (salmonids present or absent), but not temperature. The chronic objective is dependent on pH and temperature. At lower temperatures, the chronic objective also is dependent on the presence or absence of early life stages of fish (ELS). The chronic objective includes limits based on a 30-day averaging period and limits based on a 4-day averaging period.

In order to protect aquatic life, ammonia concentrations in receiving waters shall not exceed the values ~~listed~~ calculated for the ~~corresponding~~ appropriate instream conditions using the equations below and shown in Tables 3-1 to 3-43 (U.S. EPA 1999 Update of Ambient Water Quality Criteria for Ammonia).

~~*Timing of compliance with this objective will be determined on a case-by-case basis. Dischargers will have up to 8 years following the adoption of this plan by the Regional Board to (i) make the necessary adjustments/improvements to meet these objectives or (ii) to conduct studies leading to an approved site-specific objective for ammonia. If it is determined that there is an immediate threat or impairment of beneficial uses due to ammonia, the objectives in Tables 3-1 and 3-4 shall apply.*~~

~~*In order to protect underlying groundwater basins, ammonia shall not be present at levels that when oxidized to nitrate, pose a threat to groundwater.*~~

1. *The one-hour average concentration of total ammonia as nitrogen (in mg N/L) not exceed, more than once every three years on the average, the CMC (acute criterion) calculated using the following equations.*

   Where salmonid fish are present:

$$CMC = \frac{0.275}{1+10^{7.204-pH}} + \frac{39.0}{1+10^{pH-7.204}}$$

   Or where salmonid fish are not present:

$$CMC = \frac{0.411}{1+10^{7.204-pH}} + \frac{58.4}{1+10^{pH-7.204}}$$

2. *The thirty-day average concentration of total ammonia as nitrogen (in mg N/L) shall not exceed, more than once every three years on the average, the CCC (chronic criterion) calculated using the following equations.*

   Where early life stage fish are present:

$$CCC = \left(\frac{0.0577}{1+10^{7.688-pH}} + \frac{2.487}{1+10^{pH-7.688}} \right) * MIN\ (2.85, 1.45 * 10^{0.028*(25-T)})$$

   Where T = temperature expressed in °C.

   Or where early life stage fish are not present:

$$CCC = \left(\frac{0.0577}{1+10^{7.688-pH}} + \frac{2.487}{1+10^{pH-7.688}} \right) * 1.45 * 10^{0.028*(25-MAX(T,7))}$$

   Where T = temperature expressed in °C.

3. *In addition, the highest four-day average within the 30-day period shall not exceed 2.5 times the CCC.*

In order to protect underlying groundwater basins, ammonia shall not be present at levels that when oxidized to nitrate, pose a threat to groundwater.

Delete existing Tables 3-1 through 3-4 and replace with the following:

Table 3-1. Acute Objective: Selected Values for One-hour Average Concentration for Ammonia

CMC, mg N/L		
pH	**Salmonids Present**	**Salmonids Absent**
6.5	32.60	48.80
6.6	31.30	46.80
6.7	29.80	44.60
6.8	28.10	42.00
6.9	26.20	39.10
7.0	24.10	36.10
7.1	22.00	32.80
7.2	19.70	29.50
7.3	17.50	26.20
7.4	15.40	23.00
7.5	13.30	19.90
7.6	11.40	17.00
7.7	9.65	14.40
7.8	8.11	12.10
7.9	6.77	10.10
8.0	5.62	8.40
8.1	4.64	6.95
8.2	3.83	5.72
8.3	3.15	4.71
8.4	2.59	3.88
8.5	2.14	3.20
8.6	1.77	2.65
8.7	1.47	2.20
8.8	1.23	1.84
8.9	1.04	1.56
9.0	0.885	1.32

Reference: U.S. EPA 1999 Update of Ambient Water Quality Criteria for Ammonia

Table 3-2. Chronic Objective (ELS Present): Selected Values for 30-day Average Concentration for Ammonia

CCC for Fish Early Life Stages Present, mg N/L										
	Temperature, C									
pH	0	14	16	18	20	22	24	26	28	30
6.5	6.67	6.67	6.06	5.33	4.68	4.12	3.62	3.18	2.80	2.46
6.6	6.57	6.57	5.97	5.25	4.61	4.05	3.56	3.13	2.75	2.42
6.7	6.44	6.44	5.86	5.15	4.52	3.98	3.50	3.07	2.70	2.37
6.8	6.29	6.29	5.72	5.03	4.42	3.89	3.42	3.00	2.64	2.32
6.9	6.12	6.12	5.56	4.89	4.30	3.78	3.32	2.92	2.57	2.25
7.0	5.91	5.91	5.37	4.72	4.15	3.65	3.21	2.82	2.48	2.18
7.1	5.67	5.67	5.15	4.53	3.98	3.50	3.08	2.70	2.38	2.09
7.2	5.39	5.39	4.90	4.31	3.78	3.33	2.92	2.57	2.26	1.99
7.3	5.08	5.08	4.61	4.06	3.57	3.13	2.76	2.42	2.13	1.87
7.4	4.73	4.73	4.30	3.78	3.32	2.92	2.57	2.26	1.98	1.74
7.5	4.36	4.36	3.97	3.49	3.06	2.69	2.37	2.08	1.83	1.61
7.6	3.98	3.98	3.61	3.18	2.79	2.45	2.16	1.90	1.67	1.47
7.7	3.58	3.58	3.25	2.86	2.51	2.21	1.94	1.71	1.50	1.32
7.8	3.18	3.18	2.89	2.54	2.23	1.96	1.73	1.52	1.33	1.17
7.9	2.80	2.80	2.54	2.24	1.96	1.73	1.52	1.33	1.17	1.03
8.0	2.43	2.43	2.21	1.94	1.71	1.50	1.32	1.16	1.02	0.897
8.1	2.10	2.10	1.91	1.68	1.47	1.29	1.14	1.00	0.879	0.773
8.2	1.79	1.79	1.63	1.43	1.26	1.11	0.973	0.855	0.752	0.661
8.3	1.52	1.52	1.39	1.22	1.07	0.941	0.827	0.727	0.639	0.562
8.4	1.29	1.29	1.17	1.03	0.906	0.796	0.700	0.615	0.541	0.475
8.5	1.09	1.09	0.990	0.870	0.765	0.672	0.591	0.520	0.457	0.401
8.6	0.920	0.920	0.836	0.735	0.646	0.568	0.499	0.439	0.386	0.339
8.7	0.778	0.778	0.707	0.622	0.547	0.480	0.422	0.371	0.326	0.287
8.8	0.661	0.661	0.601	0.528	0.464	0.408	0.359	0.315	0.277	0.244
8.9	0.565	0.565	0.513	0.451	0.397	0.349	0.306	0.269	0.237	0.208
9.0	0.486	0.486	0.442	0.389	0.342	0.300	0.264	0.232	0.204	0.179

Reference: U.S. EPA 1999 Update of Ambient Water Quality Criteria for Ammonia

Table 3-3. Chronic Criteria (ELS Absent): Selected Values for 30-day Average Concentration for Ammonia

CCC for Fish Early Life Stages Absent, mg N/L										
	Temperature, C									
pH	0-7	8	9	10	11	12	13	14	15*	16
6.5	10.8	10.1	9.51	8.92	8.36	7.84	7.35	6.89	6.46	6.06
6.6	10.7	9.99	9.37	8.79	8.24	7.72	7.24	6.79	6.36	5.97
6.7	10.5	9.81	9.20	8.62	8.08	7.58	7.11	6.66	6.25	5.86
6.8	10.2	9.58	8.98	8.42	7.90	7.40	6.94	6.51	6.10	5.72
6.9	9.93	9.31	8.73	8.19	7.68	7.20	6.75	6.33	5.93	5.56
7.0	9.60	9.00	8.43	7.91	7.41	6.95	6.52	6.11	5.73	5.37
7.1	9.20	8.63	8.09	7.58	7.11	6.67	6.25	5.86	5.49	5.15
7.2	8.75	8.20	7.69	7.21	6.76	6.34	5.94	5.57	5.22	4.90
7.3	8.24	7.73	7.25	6.79	6.37	5.97	5.60	5.25	4.92	4.61
7.4	7.69	7.21	6.76	6.33	5.94	5.57	5.22	4.89	4.59	4.30
7.5	7.09	6.64	6.23	5.84	5.48	5.13	4.81	4.51	4.23	3.97
7.6	6.46	6.05	5.67	5.32	4.99	4.68	4.38	4.11	3.85	3.61
7.7	5.81	5.45	5.11	4.79	4.49	4.21	3.95	3.70	3.47	3.25
7.8	5.17	4.84	4.54	4.26	3.99	3.74	3.51	3.29	3.09	2.89
7.9	4.54	4.26	3.99	3.74	3.51	3.29	3.09	2.89	2.71	2.54
8.0	3.95	3.70	3.47	3.26	3.05	2.86	2.68	2.52	2.36	2.21
8.1	3.41	3.19	2.99	2.81	2.63	2.47	2.31	2.17	2.03	1.91
8.2	2.91	2.73	2.56	2.40	2.25	2.11	1.98	1.85	1.74	1.63
8.3	2.47	2.32	2.18	2.04	1.91	1.79	1.68	1.58	1.48	1.39
8.4	2.09	1.96	1.84	1.73	1.62	1.52	1.42	1.33	1.25	1.17
8.5	1.77	1.66	1.55	1.46	1.37	1.28	1.20	1.13	1.06	0.990
8.6	1.49	1.40	1.31	1.23	1.15	1.08	1.01	0.951	0.892	0.836
8.7	1.26	1.18	1.11	1.04	0.976	0.915	0.858	0.805	0.754	0.707
8.8	1.07	1.01	0.944	0.885	0.829	0.778	0.729	0.684	0.641	0.601
8.9	0.917	0.86	0.806	0.756	0.709	0.664	0.623	0.584	0.548	0.513
9.0	0.790	0.740	0.694	0.651	0.610	0.572	0.536	0.503	0.471	0.442

Reference: U.S. EPA 1999 Update of Ambient Water Quality Criteria for Ammonia

IMPLEMENTATION

Implementation Provisions for the Application of Ammonia Objectives to Inland Surface Waters in the Los Angeles Region

Acute Objective – Warm vs. Cold

It is assumed that salmonids may be present in waters designated in the Basin Plan as "COLD" and that salmonids are absent in waters designated in the Basin Plan as "WARM," in the absence of additional information to the contrary.

Chronic Objective – ELS Provision

All inland surface water bodies in the Los Angeles Region are assumed to support Early Life Stages (ELS) of fish. A site-specific study is required in order to invoke the ELS absent provision for a water body. Water bodies with a Basin Plan designation of existing for "SPWN" support high quality aquatic habitats suitable for reproduction and early development of fish and, therefore, these water bodies are designated as ELS present waters, regardless of whether a site-specific study is conducted.

Existence of Threatened or Endangered Species

Where endangered or threatened species in the Los Angeles Region may be more sensitive to a pollutant than the species upon which the objectives are based, more stringent, site-specific modifications of the criteria shall performed using one of two methods.[1]

Translation of Objectives into Effluent Limits

The use of aquatic life criteria for developing water quality-based permit limits requires the selection of an appropriate waste load allocation model. Waste load allocation models shall be based on a critical condition defined as follows:

For the acute objective (CMC), one of the following shall be used:

1. *the lowest one-day flow based on a three-year return interval (1B3) when flow records are analyzed using EPA's 1986 DFLOW procedure.*[2]
2. *the lowest one-day flow based on a ten-year return interval (1Q10) when flow records are analyzed using extreme-value statistics.*[3]

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[1] 1) If the CMC is greater than 0.5 times the Species Mean Acute Value (SMAC) for a threatened or endangered species, or a surrogate for such species, then the CMC should be reset to 0.5 times the SMAC. If the CCC is greater than the Species Mean Chronic Value (SMCV) of a threatened or endangered species, or surrogate, then the CCC should be reset to that SMCV. If the SMCV is not available, then the CCC can be reset by dividing the SMAC by the Acute to Chronic Ration (ACR) in accord with EPA's "Guidance for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and their Uses" (1985).

2) More stringent, site-specific modifications may be calculated to protect a listed endangered or threatened species by using the recalculation procedure described in Chapter 3 of the "U.S. EPA Water Quality Standards Handbook, Second Edition – Revised" (1994).

[2] U.S. EPA procedure that counts each low flow value during the year and treats it as a separate event.

3. Other appropriate critical flow condition.

For the chronic objective (CCC), one of the following shall be used:

1. the lowest 30-day flow based on a three-year return interval (30B3) when flow records are analyzed using EPA's 1986 DFLOW procedure or

2. the 30Q10 or the 30Q5 (lowest 30-day flow based on a ten or five-year return interval) when flow records are analyzed using extreme-value statistics.

3. Other appropriate critical flow condition.

Waste Load Allocations (WLA) are then calculated using the following equation:

$$WLA = Cd = \frac{Cr(Qd+Qs)-(CsQs)}{Qd}$$

Where Cd = Pollutant Concentration of Discharge (mg/L)
Cr = Pollutant Concentration of Downstream (mg/L)
Cs = Pollutant Concentration of Upstream (mg/L)
Qd = Flow Discharge (mgd or cfs)
Qs = Flow Upstream (mgd or cfs)

Waste Load Allocations based on a critical condition of 30Q10 are protective of both the 30-day average and the 4-day average. If a 30Q5 is used, it must be demonstrated that the 7Q10 (seven-day low flow which recurs once every ten years on the average) is protective of 2.5 times the CCC, to ensure that short-term (4-day) chronic toxicity does not occur. The more stringent (i.e. lower) of the 30Q5 or the 7Q10 shall be used.

Procedures outlined in the "Technical Support Document for Water-Quality-Based Toxics Control" (TSD) shall be adjusted when implementing the ammonia objective to accommodate the 30-day averaging period to calculate NPDES permit limits.

The equation to determine the chronic long-term average concentration (LTA_{c30}) shall be modified as follows to address the 30-day averaging period:

$$(LTA_{c30}) = WLA_{c30}\, e^{[0.5\sigma_{30}^2 - z\sigma_{30}]}$$

$$\text{where } \sigma_{30}^2 = \ln(CV^2/30 + 1)$$

WLA = waste load allocation; CV = coefficient of variance

The acute Long-Term Average (LTA_a) and 4-day (sub-chronic) Long-Term Average (LTA_{c4}) shall be performed using the equations in the TSD and the maximum daily limit (MDL) and average monthly limit (AML) shall be calculated from the LTA_{min}.

[3] U.S.G.S. procedure that counts only one value per year, the lowest daily flow in that year, and therefore does not consider the duration of such low flows that may occur in each year.